

At first sight the human body may appear too highly specialised to serve as an efficient type for comparison, but in reality this is not so. The fact that the ordinary mammal presents a side view to the artist while the human body is usually studied from the front is merely one of detail. The chief points in which the human and ordinary mammalian bodies differ relate to the head and limbs, and the limbs of man are more primitive in structure, less specialised and evolved than those of the ordinary domestic animals. The evolution of the quadrupedal limbs forms an interesting study in high specialisation of one or more digits and retrogression in others, and it is from this standpoint that M. Cuyer deals with the anatomy of the extremities of the domestic animals. Through the limbs of the cat, dog, pig, ox and horse he traces the gradual retrogression of the clavicle, muscles of supination and pronation, ulna, and lateral digits, and shows how these modifications are due to the specialisation of the limbs as organs of pure support instead of mixed instruments for prehension as well as support. His discovery of a vestige of the *pronator radii teres* in the horse is of great interest; how many millions of years is it since the ancestor of the horse required to supinate or pronate its arm?

In the hands of the artist the whole perspective of anatomy becomes changed, and it would be for the benefit of our text-books if the pure zoologist sometimes looked at his work with the eye of an artist. M. Cuyer recognises the fact that an observation on the dead animal remains dead until it is transferred to the living, and the great merit of his work is that he lays a greater emphasis on the actions than on the attachments of muscles. External form, expression, and action are the points which an artist seeks to understand; hence the systems of the body dealt with here are the skeleton, muscles, proportion, and movements. Everyone must have noticed the marked difference in form between the haunches of an ox and of a horse, yet it is doubtful if any of our modern comparative anatomists could indicate the meaning of these structural differences.

Marey's work forms the basis of the chapters in which are described the various characteristic movements of the horse. In dealing with the proportions of the ideal horse M. Cuyer holds the common-sense opinion that there is no absolute standard such as that suggested by Bourgelat, who held that the length of the body from the shoulder to the rump should measure the same as the height at the withers. The observations of Colonel Duhouset on fifty Arabian horses are quoted; in ten of these the length and height were equal; in twenty-six the height was decidedly the greater measurement; in fourteen the length was the greater.

M. Cuyer, as is the habit with many French scientific writers, quotes no author outside the limits of his country. On p. 33, for instance, he refers to an observation by Marey, made in 1890, that there is no correlation between the power of flight and the development of air cells in birds. This matter was fully studied and accurately described in the well-known work of John Hunter a century before Marey was born.

HINDU CHEMISTRY.

A History of Hindu Chemistry from the Earliest Times to the Middle of the Sixteenth Century A.D., with Sanskrit Texts, Variants, Translation and Illustrations. By Prafulla Chandra Rāy, D.Sc., Professor of Chemistry, Presidency College, Calcutta. Vol. i. Pp. lxxix + 176 + 41. (London and Oxford: Williams and Norgate, 1902.) Price 12s. 6d. net.

THE origin of Hindu chemistry is hidden in the obscurity of past ages. It is certain that the alchemists of western Europe owed much of their learning to the Arabs. M. Berthelot, in "*Les Origines de l'Alchimie*," has shown that the Arabs derived many of their ideas from the Greeks, but Dr. Rāy quotes other weighty opinions, and furnishes additional evidence in support of the view that the Arabs were even more indebted to the Hindus. In the eighth century the Caliphs of Bagdad ordered several of the medical works of India to be translated, and both then and later learned Arabs were sent to India to study science. Not content with pointing out these facts, Dr. Rāy reminds his readers that the Greeks themselves derived their knowledge of many things from the Hindus, who had, for example, solved the 47th proposition of the first book of Euclid, 200 years before the birth of Pythagoras. Relying on this and similar evidence, Dr. Rāy places the date of the works of Vāghbata at some time before the eighth century A.D., and the surgical and medical treatises of Susruta and Charaka many centuries earlier, in pre-Buddha times. The last-named book, however, "embodies the deliberations of an international congress of medical experts, held in the Himālayan regions," and the fourth veda, the Atharva-veda, appears so archaic by its side that it must be older by "probably a thousand years or more." In the Atharva-veda "plants and vegetable products in general are fully recognised as helpful agents in the treatment of diseases," and at that period (say 2000 B.C.) alchemical notions had already gathered round gold and lead, gold being regarded as the elixir of life, and lead as the dispeller of sorcery.

The progress of chemistry in India, if it were judged only from the manuscripts still in existence, would appear to have been bound up with the study of medicine. Preparations of mercury and other metals were described, and their use recommended in various diseases, several centuries before the time of Paracelsus, the internal use of the black sulphide of mercury dating from the tenth century A.D. at the latest. There are, however, many signs that the study of metals had already progressed far beyond the knowledge required by the medical practitioners.

Thus in "*Rasarnava*" (twelfth century) we read "copper yields a blue flame . . . that of the tin is pigeon-coloured; that of the lead is pale tinted," and as another example:—

"A pure metal is that which, when melted in a crucible, does not give off sparks nor bubbles, nor spurts, nor emits any sound, nor shows any lines on the surface, but is tranquil as a gem."

Then there is the Kutab pillar near Delhi, a wrought-iron column which weighs ten tons, and is some 1500

years old, the huge iron girders at Puri, the iron-roofed temple porch at Kanurac, and other relics which show the ancient familiarity of the Hindus with this metal. In the fourteenth century brass and bell-metal were stated to be alloys, and zinc, copper and tin to be metals. The manufacture of gold jewellery is also of great antiquity in India.

Dr. Rāy has ably carried out his task of proving that the ancient lore of the Hindus was far in advance of that of the rest of the world, China excepted. The reader who is unversed in Sanskrit may perhaps be pardoned if he sometimes loses himself for a moment in the maze of Hindu names, and it will be well if his "discerning faculty is nimble and agile, and can suddenly surround a proposition." A glossary would be useful, but could scarcely add to the interest of the volume. The second volume, promised when Dr. Rāy has examined further manuscripts, will be welcome.

T. K. R.

OUR BOOK SHELF.

The Soil: an Introduction to the Scientific Study of the Growth of Crops. By A. D. Hall, M.A. Pp. xiii + 286. (London: J. Murray, 1903.) Price 3s. 6d.

WHEN one who has been for many years both a teacher and an investigator commits to paper the facts and ideas which have formed the substance of his later courses of instruction, we expect a very useful book, and in the present instance we are certainly not disappointed. The book before us takes a wide scope; it deals with the origin of soils, their physical properties, their chemical properties and composition, methods of analysis, the living organisms within the soil, the causes of fertility and sterility, soil types and the natural flora belonging to each. The book is primarily intended for college students. Owing to its wide scope it does not attempt to treat any part of the subject in an exhaustive manner; it possesses, however, the great merits of originality and suggestiveness, virtues which are not always to be found in the formal text-book. A prominent feature of the work is the introduction of the results of investigations carried on by the author while principal of the Agricultural College at Wye. English books on scientific agriculture have hitherto been so necessarily filled with descriptions of foreign researches that any results obtained under English conditions have an exceptional value, and appeal to the farmer in a special manner.

In a work dealing with so many subjects, there are naturally some points open to criticism. The author seems to hesitate in attributing some of the physical properties of soil constituents to their colloid nature, and thus leaves unexplained the enormous amount of hygroscopic water held by humic matter. The indigo method of determining nitrates is mentioned as one that may be used for determining nitrates in soil extracts; the method is, in fact, unsuitable for this purpose, as it gives results much below the truth owing to the presence of organic matter. Nitrification is occasionally spoken of as a kind of "fermentation"; objection may surely be taken to this description. Fermentation is a word of wide meaning, but it surely should not include the oxidation of inorganic matter by a living organism. The chapter dealing with the power of soils to retain various bases and acids is full of interest, yet the theory is incompletely stated, the results of the German, French, and some English

investigations on the subject being unnoticed. The laws governing the diffusion of salts, and the results of their molecular diffusion in a moist soil, are also not noticed. The cause of the sterility of alkali lands, and their proper treatment, are, however, well discussed, and many excellent illustrations of the subject are introduced from the experience gained in Egypt.

In a book dealing with many details some slips will inevitably occur; the most important one in the present case is that King's determinations of nitrates in fallow soil appear as determinations of nitrogen as nitrates; the quantity of nitrates present is thus unintentionally much exaggerated.

The concluding chapters on fertility and soil types exhibit most fully the thoroughly practical character of the author's teaching, and will be much valued by many readers. The book is sure to meet with a favourable reception.

R. W.

Electrical Problems for Engineering Students. By W. L. Hooper, Ph.D., and R. T. Wells, M.S. Pp. v + 170. (Boston and London: Ginn and Co., 1902.) Price 6s.

THIS is a collection of numerical and mathematical exercises in electrical engineering, starting from the most elementary beginning and ending in the more difficult problems presented by the design and working of direct and alternating current dynamos and motors. The exercises have been tested by the practical experience of the authors at Tuft's College, Mass., and are such as would form a useful accompaniment to a two or three years' lecture and practical course. A distinctly good feature of the book is the number of examples requiring graphical solutions, which cannot fail to impress upon the student the advantages gained by plotting curves. It is always an objection to exercises of this sort that they tend too much to the purely arithmetical and academic side of the subject; thus, many of the problems on subjects which are treated only in an elementary manner in this book are little better than arithmetic sums. For example, in the twelfth chapter, on electrochemistry, there are eleven problems, which are all practically simple proportion sums, and we doubt if the student would gain much more by solving them than he would by solving an equal number of problems on, say, the number of able-bodied men and boys required to till a field. But, if the book be used with discretion, these drawbacks will be lessened, and provided the student is taught in other ways to think about and really understand his subject, these exercises will serve to give him a facility in attacking numerical problems as they arise. The book should prove a useful aid to students and teachers of electrical engineering.

M. S.

Open-Air Studies in Bird Life; Sketches of British Birds in their Haunts. By C. Dixon. Pp. xii + 280; illustrated. (London: Griffin and Co., Ltd., 1903.) Price 7s. 6d.

MR. DIXON appears to consider that the appetite of the British public for books on the birds of their own islands is insatiable, and as he seems to find a publisher for all his works on this subject, he is perhaps justified in this opinion. In the present instance the subject is treated from a standpoint somewhat different from the one usually adopted, the birds being described in connection with their environment or "station," instead of systematically. Although this mode of treatment necessarily involves a certain amount of repetition (as in the case of the sparrow and the lapwing), it permits the descriptive side of the subject to be relegated somewhat to the background,